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socSMCs: Socializing Sensorimotor Contingencies

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This column will try to describe the characteristics of current cyberpsychology research in Europe. In particular, CyberEurope aims at describing the leading research groups and projects running on the other side of the Ocean.

In order to cooperate with humans safely and meaningfully, robots must be able to interact in ways that humans find intuitive and understandable. Therefore, robots must develop an advanced real-world social intelligence and be transparent with respect to the causes and reasons for their actions to human users.

As robots become more omnipresent in our society, we are facing the challenge of making them more socially competent. Addressing this challenge, this project proposes a novel approach for understanding and modeling social behavior and implementing social coupling in robots. The planned approach presents a radical departure from the classical view of social cognition as mind reading, mentalizing, or maintaining internal representations of other agents.

The project is based on the view that even complex modes of social interaction are grounded in basic sensorimotor interaction patterns. Sensorimotor contingencies (SMCs) are known to be highly relevant in cognition. The key hypothesis is that learning and mastery of these action–effect contingencies are also critical for predicting consequences of the action of others and thus for enabling effective coupling of agents in social contexts. The project will investigate socSMCs in human–human interaction (HHI) and human–robot interaction (HRI) scenarios. Specifically, the objectives of the project target three societal challenges: (a) improving the social competencies of robots, (b) understanding the mechanisms of human social interaction, and (c) applying these insights for improving the condition of people with disturbances of social cognition.

All objectives of the socSMCs approach will be benchmarked in several demonstrator scenarios. The long-term vision is to realize a new socially competent robot technology grounded in novel insights into mechanisms of functional and dysfunctional social behavior, and to test novel aspects and strategies for HRI and cooperation that can be applied in a multitude of assistive roles relying on highly compact computational solutions.

The project will also contribute to a qualitative change in HRI and human–robot cooperation, unlocking new capabilities and application areas together with enhanced robustness and monitoring. It aims at investigating socSMCs in nonverbal social interaction scenarios. It will explore to what degree such implicit mechanisms can be enhanced by cross-modal augmentation approaches using sonification and haptification of socially affording sensorimotor signals.

The project will test a novel model of social behavior, leading to novel ways of quantifying social coupling. In particular, the project will pioneer a new approach for testing the salience and effectiveness of social affordances in humans. This approach will define innovative strategies for realizing and benchmarking HRI scenarios.

This approach will enable introducing new concepts for robotics overcoming divides in HRI, facilitating training

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of social abilities in people with autism spectrum disorder, and further generalization toward ambient assisted living, care giving, interactive social games, and online scenarios. The sonification and haptification of socially affording stimuli and coupling patterns that we explore here may enhance social entrainment in both HHI and HRI scenarios. For example, work on distal socSMCs in joint attentional search could enhance the use of online resources by facilitating search through shared attentional cues and augmented feedback. The socSMCs approach could also have an impact on the development of assistive technology for social entrainment, which might be implemented, for example, as smartphone-based apps for interpersonal synchronization using sonification and online estimation of sensorimotor entrainment.

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